

Notes on dédoublement.

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Trillium sessile. Three interesting cases of more or less quaternate structure in this species of *Trillium* have recently come under our observation. One of these is quite simple in character. First came a pair of opposite broader leaves, followed in decussating order by a pair of narrower leaves, an outer pair of sepals, an inner pair of sepals, then by a set of four petals decussating with the two sets of sepals taken as a whole, next by four outer stamens, these by four inner stamens, but of practically similar insertion, and lastly by an ovary which bore four distinct styles.

Mr. Ed. Rynærson, teacher of botany at the Dayton High School, found a vastly more interesting case which he placed at the writer's disposal. To appreciate this fully it must be remembered that the sepals of this species are green and the principal veins are longitudinal and parallel, while the petals are dull purple brown in color and have veins which incline

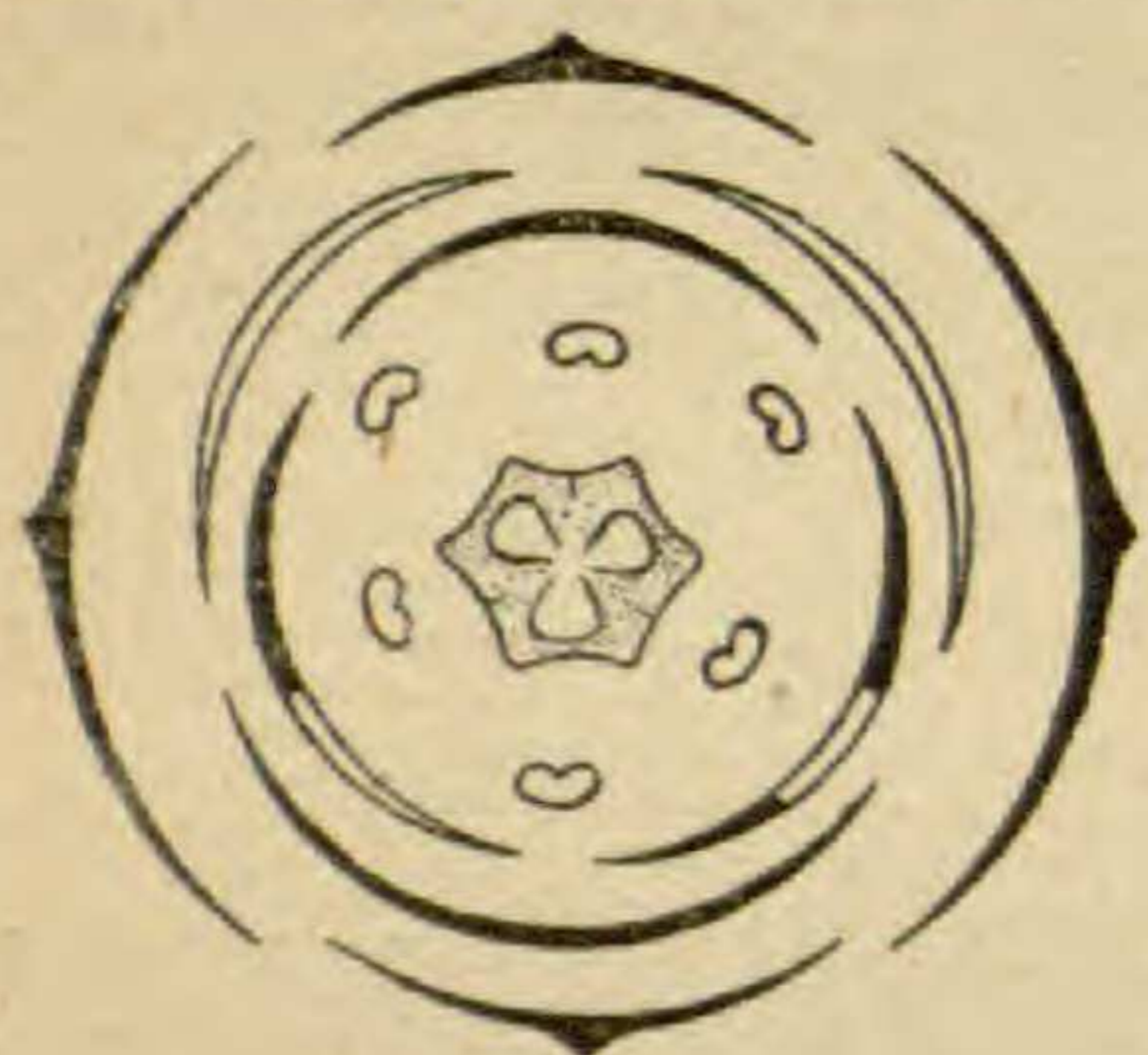


Fig. 1.

towards either side of the petals and show more or less of an anastomosing structure. First there is a pair of opposite leaves (fig. 1), next a pair of slightly narrower leaves. With these four leaves as a whole, the sepals if there be four acting together as a whorl should decussate. And with these four sepals four petals should decussate. To determine how a plant

with only six floral envelopes could manifest this tendency might puzzle a mathematician, but the question has been solved by this curious plant in a very odd manner.

On either side of one of the second pair of leaves is found a sepal in decussating position. On either side of the opposite leaf is found a floral envelope in position a petal but in appearance partly petal and partly sepal. One of these is colored and veined like a petal on the outer half, and colored and veined like a sepal on the inner half, so that this inner half falls in the proper space to represent a third sepal. The other floral envelope is colored and veined like a petal on the

outer half; the strip along the inner half of the petal for about a quarter of the width of the floral leaf is green and parallel veined like a sepal, but the quarter strip on the inner edge of this floral leaf is again colored and veined like a petal. The result is that these two floral envelopes, petals in position on a ternate arrangement, show sepal character along their inner halves, where the other pair of sepals should be on a quaternate plan.

To complete the analogy that third floral envelope on a ternate plan which should be a sepal, shows all the characters, both in color and venation, of a petal. Opposite to this between the two undoubted sepals is found the regular petal. On either side, to complete the quaternate whorl, would then come those halves of the peculiar floral envelopes described above, which are colored and veined like petals. The purple color and anastomosing veins on the other side of the purple strip can not destroy this analogy, but only add to the interest of the case. The tendency towards quaternate structure induced by the four leaves is therefore shown by the coloring and venation of the floral envelopes, while the return to the ordinary ternate structure is heralded by the actual number of floral envelopes (6) produced. There are six stamens and three styles.

In a third case, also found by Mr. Ed. Rynærson are found two leaves (fig. 2), followed by two other leaves; decussating with these are four sepals; almost decussating with those at three places are three petals, heralding the return to the ternate type, and at the place where the fourth petal ought to be, two stamens are found, attached by their filaments below, of which that stamen which should according to the

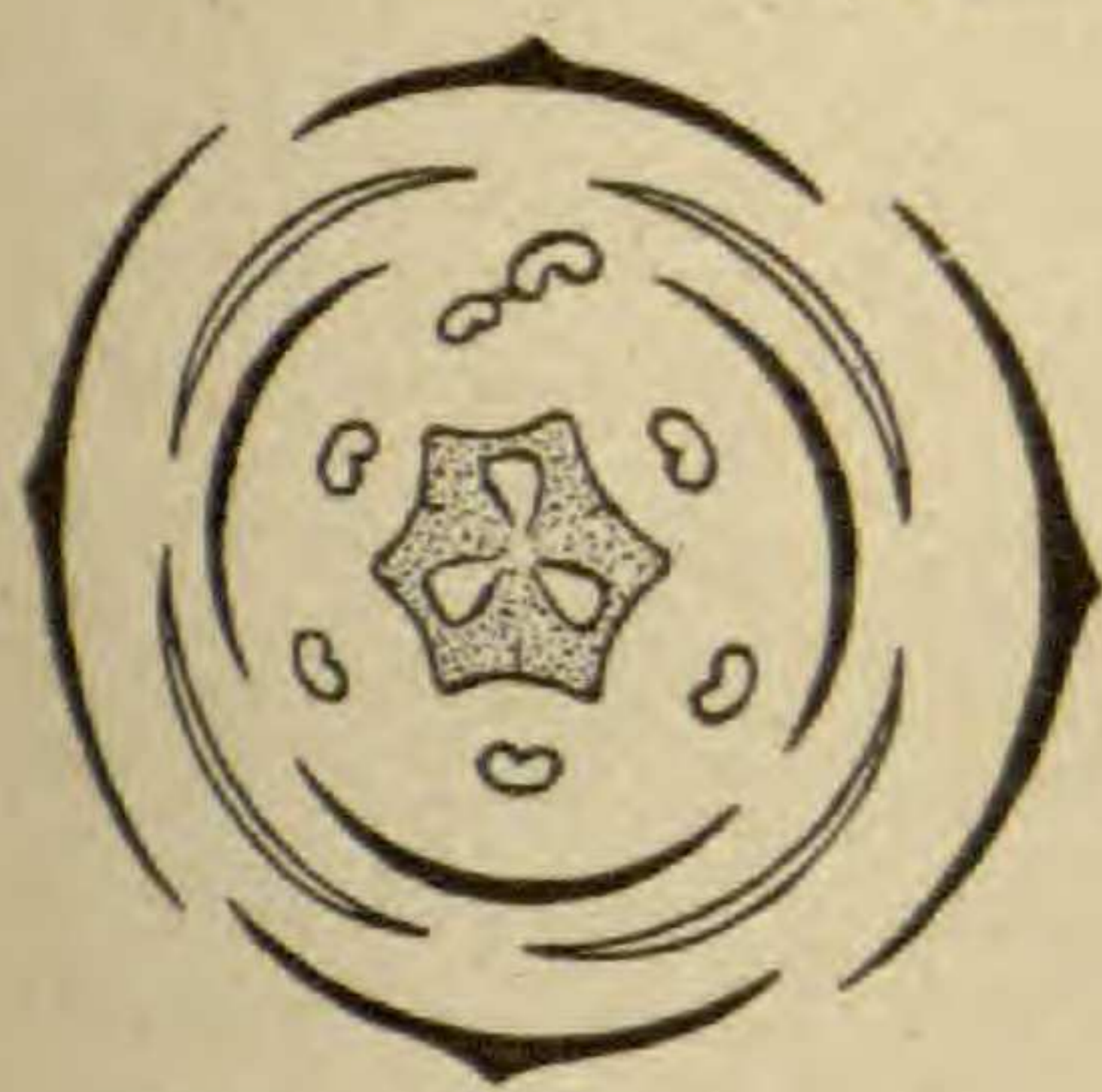


Fig. 2.

quaternate plan be the fourth petal has a somewhat broader filament. Not counting this half of the compound stamen, there would be six stamens, following the three petals in regular ternate order. Including that half of the stamen there would be seven stamens, but with that interpretation, if viewed only as an ordinary stamen, there would be no logical explanation of the sequence of the floral leaves, or of the presence of the seventh stamen. There are three styles.

Nothing could be more interesting from the point of view of phyllotaxy than this attempt of plants to maintain a quaternate phyllotaxy, after numerically they had gone over to the normal ternate plan.

A fourth case, also found by Mr. Rynærson, has three ordinary leaves in ternate order (fig. 3). There are two ordinary

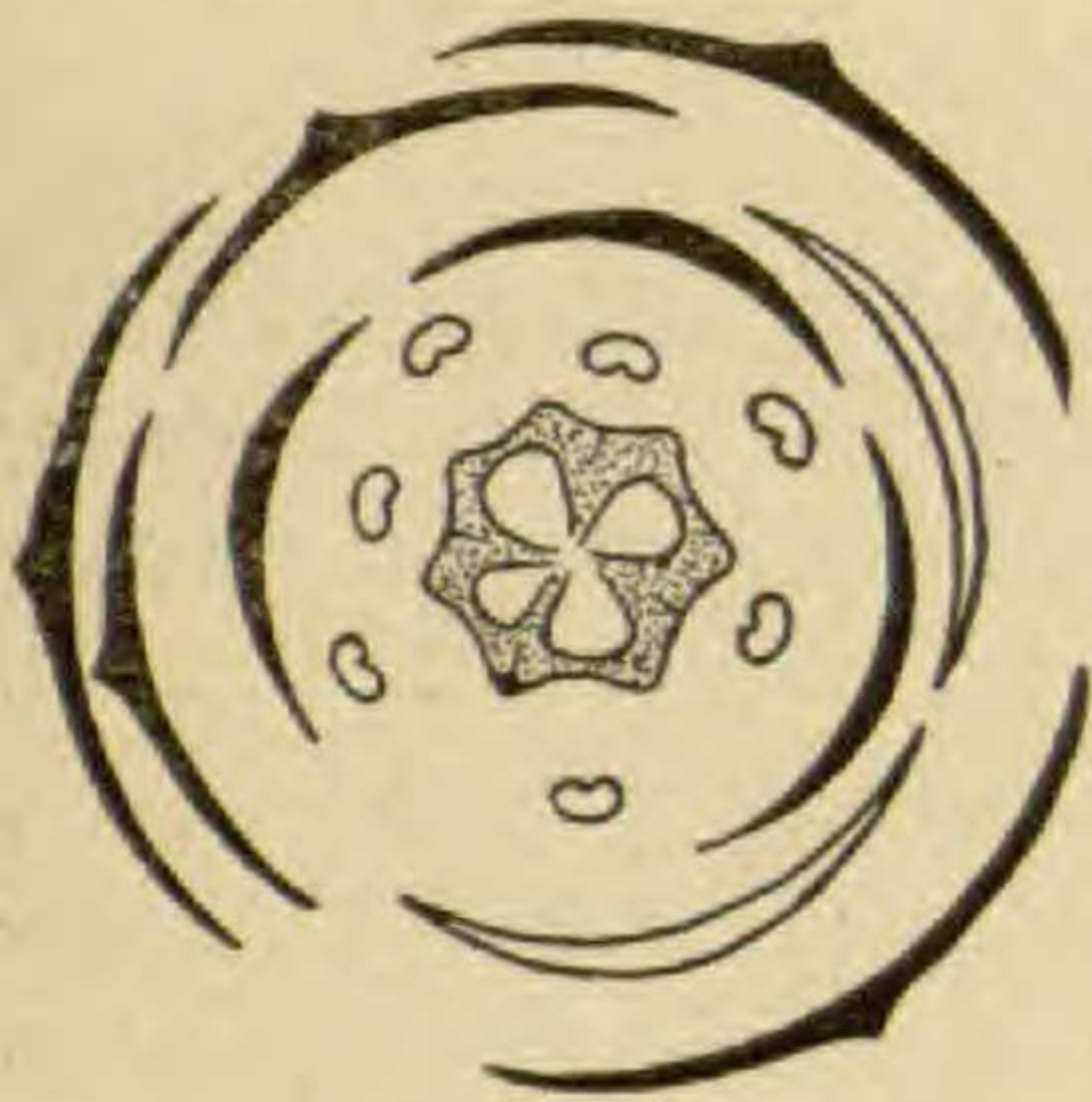


Fig. 3.

sepals, and the third one has been replaced by a green leaf of about one-half the ordinary size, but divided almost to the very base, the venation of each half near the base being obliquely outward as when forming part of an entire leaf. The result is that the two divisions of the leaf-like sepal and the two ordinary sepals take up a position which is ternate to a certain extent and decussate with reference to the normal leaves, but more quaternate when considered among themselves. It is impossible to reproduce this effect satisfactorily in a diagram. Decussating with this set should come four petals if the quaternate plan is to be carried out. The fact is that the petals do decussate, but there being only three petals, this leaves one space vacant. Next on the quaternate plan there should be four stamens, one above each of the two normal sepals, and one above each division of the leaf like sepal. These are present. Next should be found four stamens, one over each of the petals present, and one over the space left vacant in the row of petals; but the last one does not occur, thus showing a return to the ternate order numerically but not necessarily in position. Finally, if the quaternate arrangement is to hold, one style should appear over each of the outer (four) stamens. These occur, but one of them is smaller and its cell is narrower than in the rest. The numerical order is therefore three, four, three, four, three, four, the quaternate *position*, however, being maintained, even where the actual number of parts had gone back to the ordinary arrangement in threes.

Ulmus. Mr. W. B. Werthner, teacher in the High School here and an expert botanist, found this spring on McDaniel St. a very interesting set of cases of *dédoublement* of leaves which seemed to be quite common in the young vigorous elms along

here and an expert botanist, found this spring on McDaniel St. a very interesting set of cases of *dédoublement* of leaves which seemed to be quite common in the young vigorous elms along

the sidewalk. He very kindly placed this material at the disposal of the writer. The trees had recently been pruned, and the material in question consisted of the twigs which had fallen into the street. It being early spring, only the leaf-scars remained to indicate the fallen leaves, but the scaly leaf buds were well shown. We will use the term leaves instead of leaf-scars.

In the most interesting case the third node above the cut end of the twig showed a bud in the axil of the leaf, and a smaller one in the axil of the lower stipule. Two leaves, each subtending a bud, occur after intervals of six, four, seven, six, and again of six nodes, in the last case the pair appearing just beside the terminal scar. There is here a sort of tendency towards the recurrence of *dédoublement* after an interval of about six nodes.

On a second twig, one of the lowest nodes shows also a bud in the axil of a leaf and a second smaller bud in the axil of the lower stipule. At the fourth succeeding node the leaves are opposite and do not maintain the usual lateral position of the one half phyllotaxy, the pair having a diagonal position. Above this point every alternate leaf is separated by a shorter internode from the leaf below, so that the leaves have an evident tendency to form decussating pairs. First are found three pairs, of which the leaves are separated by shorter internodes, then one pair of which the leaves are opposite, next a pair of which the leaves are separated by shorter internodes, and finally at the tip of the stem, a pair of leaves which are opposite, and on each side of the terminal scar. The tendency to form decussating pairs is here very marked, and is fully successful at irregular intervals.

In a third case, two leaves, each subtending a bud, occur at the fifth node from the cut end, and also at the fourth succeeding node. Then two buds occur separated by shorter internodes, and next are found two leaves subtending a single bud placed in their conjoint axil. At the second axil above this two leaves each subtending a bud occur. Then come two buds separated by shorter intervals, and next two leaves, with two buds, of which one is larger. After this come five buds presenting a sort of two-fifths phyllotaxy.

On a fourth twig the second node bears two leaves subtending as a pair but a single bud. At the second node above are two leaves each subtending a bud; this recurs at the fifth suc-

ceeding node, and is followed by two leaves separated by a shorter internode, and then by two which are almost opposite, and these in turn by two leaves at the same node, each subtending a bud. The pairs of the whole series decussate after a fashion. At the third node above occur two leaves, as a pair subtending a single bud. At the second succeeding node are two leaves each with a bud, and then follow six or seven buds, as far as the tip of the twig.

On a fifth twig two leaves, as a pair subtending a single bud, are followed in the same vertical plane by two opposite leaves and buds, and these by a similar pair in decussating position. Next follow ten leaves in a sort of spiral phyllotaxy, the alternate leaves being separated by shorter and shorter internodes on going higher up on the twig, so that the ninth and tenth leaves are again almost opposite. Then the phyllotaxy becomes spiral again. A branch growing from this twig shows at one node a bud in the axil of a leaf and a second bud in the axil of a stipule.

As a series these twigs show a tendency to recurrence of the abnormal phyllotaxy even after a more or less successful return to normal conditions. The presence of two leaves (or rather leaf-scars) subtending a single bud, and occasionally of a bud also in the axil of a stipule, is especially interesting.

Arisæma triphyllum. Marion Nichols, one of the pupils of the High School, brought in a remarkable case of *dédoublement* in the Indian turnip. Two leaves have developed on the same petiole. The petioles coalesce perfectly below, but show an impressed line in front and in the rear towards the top. The middle leaflet of each leaf is of course distinct; so are also the two inner leaflets of each leaf. On the contrary, the two outer leaflets, which one might expect to be farthest removed, have grown together along their midribs, but are free elsewhere. In the axil of this double leaf is a double flowering stem also coalesced perfectly below but bearing an impressed line above, and bearing on each side a "flower," both spathes being well developed but placed back to back, the open ends therefore facing away from each other. The spadix in each case bore only ovaries. It will be seen at once that this is a case similar to many of those mentioned in the case of the elms, where by *dédoublement* two leaves appeared at one node, and each leaf bore a bud in its axil, only in the case of the Indian turnip the *dédoublement* has not gone to the extent of perfect separation of the parts.

Podophyllum peltatum. The numerical floral plan given by Eichler in his *Blüthendiagramme*, 2: 137, based upon the work of Payer and Baillon, assumes a ternary arrangement of the stamens, of which the outer circle contains *three stamens*, and the inner *nine stamens in three groups* of three stamens

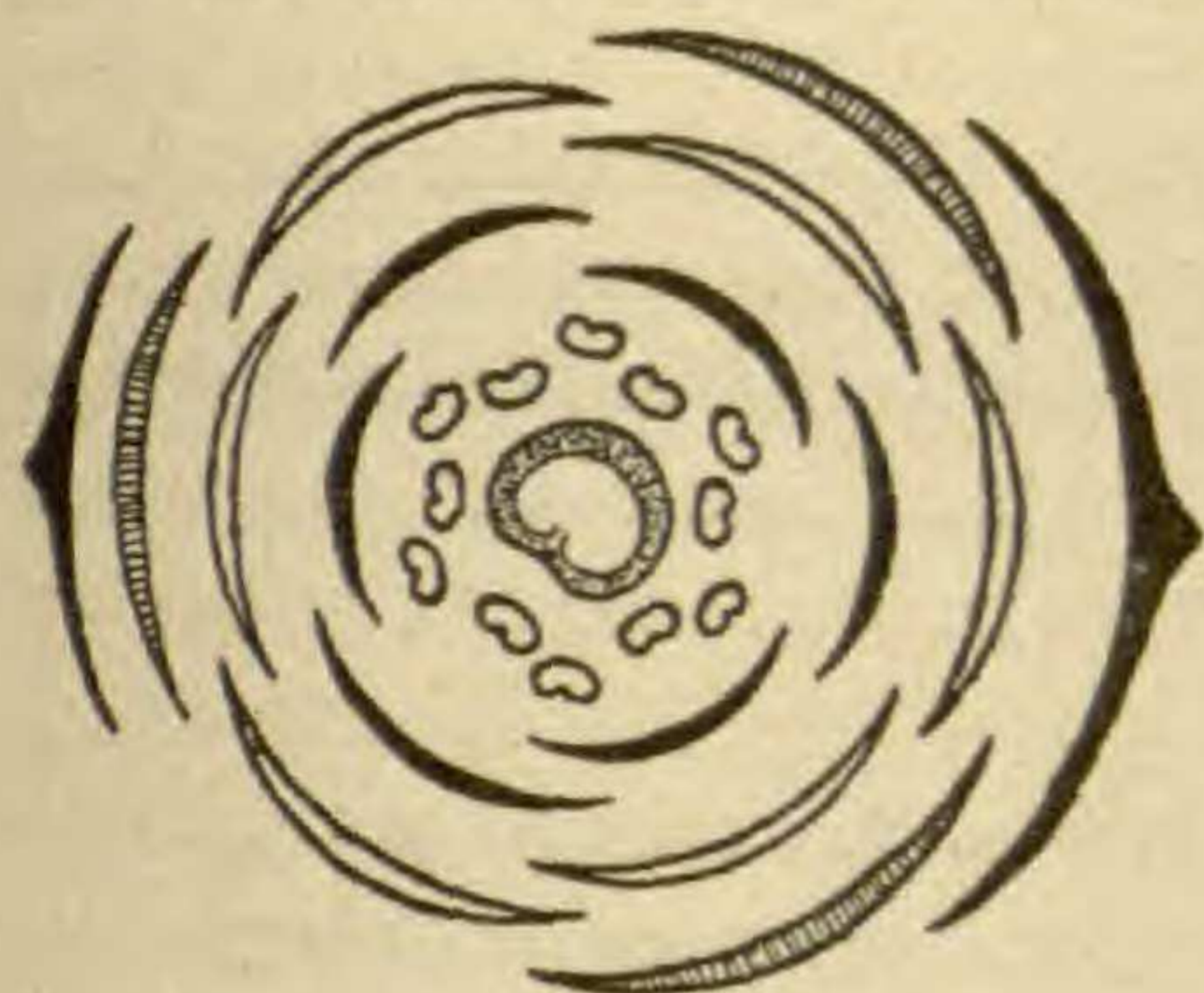


Fig. 4.

each, each group being considered a single but compound stamen. That this is not a correct interpretation can be readily seen by one having access to abundant fresh material. The typical plan is undoubtedly ternate (fig. 4). As is well known from aberrant occurrences and from other species, the leaves are not truly

opposite, but alternate, the terminal flower having on this account the appearance of appearing higher up on the side of one of the petioles. This fact has been emphasized in the diagrams. The three bracts and six sepals are introduced in accordance with the interpretation of Asa Gray, which accords with the general ternate structure of the petals and stamens. The position and number of the petals and stamens and of the placenta of the ovary are taken from an occurrence actually at hand at the time the drawing was prepared. There are evidently three petals, with which decussate three more petals, and with these as a whole decussate first six stamens, and then again six stamens. Nothing can be more improbable than the peculiar occurrences of ternary *dédoublement* assumed by these distinguished authors.

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